CLINICAL REPORT

THE HALLIWICK CONCEPT, PART I

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ABSTRACT

James McMillan developed the Halliwick Concept over 50 years ago. Initially, the Halliwick Concept was developed as an instructional strategy (called the Ten-Point Program) for teaching swimming to children with disabilities. Soon after the introduction of the Ten-Point Program (at the Halliwick School for Crippled Girls in London), the teaching staff began to notice positive change in the physical and emotional behaviors of the children. The changes in behavior were attributed to a unique teaching/learning philosophy and a psycho-sensory motor learning program that is enhanced by hydrodynamics. Recognizing the therapeutic effects of the Ten-Point Program, McMillan and his colleagues adapted the program as a therapeutic intervention called Water Specific Therapy or the Logic Approach to Therapy in Water.

Key words: Halliwick Concept, Ten-Point Program, Water Specific Therapy, Aquatic Rehabilitation

INTRODUCTION

James McMillan (1913-1994) first conceived of the Halliwick Concept as a strategy to teach swimming to individuals with disabilities. The concept uses fluid mechanics to enable students to achieve stability and controlled movement in the water.[10, 13] McMillan called the concept the Ten-Point Program and in 1950, introduced it at the Halliwick School for Crippled Girls in London. The therapeutic value of the Halliwick Concept was quickly noted. In fact, the results were remarkable! Within weeks, not only did the children learn to swim but they also demonstrated improvement in head balance, trunk stability, breath control and self-esteem.

McMillan and his colleagues founded the Association of Swimming Therapy and over the next thirteen years continued developing the concept. Although their intentions were recreational, the therapeutic impact of the program was evident. In 1963, McMillan was asked to teach the Halliwick Concept at the medical center in Bad Ragaz, Switzerland.[9] McMillan continued advancing the Halliwick Concept for the next twelve years. The Ten-Point Program continued to impress the medical staff at Bad Ragaz and he was hired (1975-1979) as the project leader to extend the Halliwick Ten-Point Program as Water Specific Therapy (also known as the Logic Approach to Exercise in Water). (NOTE: McMillan also redesigned aspects of the Bad Ragaz Ring Concept (BRRM) to attend to the ergonomic needs of those using BRRM).

Today, after over fifty years of development and implementation, the Halliwick Concept is one of the most important strategies in aquatic therapy, especially in neurology and pediatrics.[5, 7, 8, 14] This article will address the therapeutic aspects of Halliwick both as an instructional technique and therapeutic intervention.

HALLIWICK: THE PHILOSOPHY

The goal of the Halliwick Concept is to enable the participant to achieve maximum independence both in the water and on land. Towards that end, McMillan created a teaching philosophy and structure that would facilitate and encourage self-reliance. The development of the philosophy and structure was interdisciplinary. Following a General Systems Theory approach, McMillan worked with

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professionals from other fields (e.g. allied health professionals and teachers) to apply information from kinesiology, pathology, psychology and didactics to a water environment. The result was a teaching philosophy and a psycho-sensory motor learning program that would become the basis for the Ten-Point Program.

The philosophical notions and concepts that are the underpinnings of the Halliwick Concept (Figure 1) were presented at a conference on the Halliwick Concept in 1986 at the University of Nijmegen in the Netherlands.[7] McMillan believed that everyone is a swimmer and that swimming is a means to independence (not the goal). An essential skill in becoming a swimmer is balance. Balance is dependent upon body shape and density. A swimmer, especially one with neurological impairments, may require assistance to establish and maintain balance. Only a one-to-one helper should provide this support. Floatation devices are never used because they encourage dependence which may significantly impair the goal of independence. Finally, becoming a swimmer requires active participation and is most effective in groups.

HALLIWICK: THE MOTOR LEARNING PROCESS

The goal of Halliwick is independence and is demonstrated as controlled movement. When in the water, balance requires adaptation to the mechanical changes in the environment. The adaptations are the result of a psycho-sensory motor learning process. This is a process that enables the individual to learn how to maintain balance in an unstable environment. Once balance (stability) is established, movement can be initiated and controlled.

McMillan understood the relationship between balance and movement. He realized that in order for children with neurological impairments (e.g., problems with coordination, comprehension, perception and/or pain) to learn to swim (initiate and control movement), they must first learn to balance. Establishing and maintaining balance was not simple, and often impossible, for the children. His response was to develop manual assistance techniques (handling techniques) that would enable the students to learn control of rotational patterns. Based on his observations, McMillan suggested that there was a relationship between fluid mechanical effects and adaptive body mechanics related to inertia, which in many cases, coincided with "primitive reflexes." McMillan accepted the notion of "primitive reflexes" while others were embracing different views of motor learning (e.g., Bobath).

Everyone is a swimmer!

Swimming is a means to independence, not a goal in itself.

Balance depends mainly on body shape and density.

Proper supports are essential.

Most activities require a 1-to-1 attendance/support.

Floatation aids are **never** used.

The student participates actively in all activities.

Most activities take place in groups.

Figure 1: The Halliwick Philosophy

It was not until later that neurophysiology understood the significance of handling techniques as exteroceptive cues or plasticity. Similarly, it is widely accepted that the physical properties of any environment are a major constraint to balance and that individuals show adaptive motor behavior (e.g., widening the base of support, using hand for support and stiffening the body in order to stabilize the center of gravity).[2] These adaptive motor behaviors (also referred to as stress behaviors) are consistent with McMillan's notion of "primitive reflexes."[7]

HALLIWICK: CONSIDERING TWO UNIQUE HYDRODYNAMICS FACTORS

Exteroceptive cues (plasticity) and adaptive motor behavior in the presence of hydrodynamic elements resulted in a psycho-sensory motor learning program that is the Halliwick Concept. The hydrodynamic elements generally accepted as influential in aquatic therapy also play an important role in Halliwick. In Halliwick, however, the most important fluid mechanical effect is commonly referred to as "metacentric effects." Metacenter is a naval architectural term used to describe the point around which the force pendulum of gravity and buoyancy rotate. Both forces are equally important and influential with small changes in either gravity or buoyancy causing imbalance. The shape, density and (a)symmetry of a body will influence the metacenter (equilibrium). In water, balance occurs when a body makes necessary adjustments to cause the forces of gravity and buoyancy to be equal and directly opposite of each other. When these forces are not equal and co-linear, the body will become

unstable causing it to rotate to reach balance. The body uses automatic reactions to balance and stabilize posture, based on laws of inertia (increase of a rotational radius slows down velocity). In cases where loss of balance cannot be coordinated well, the body uses patterns based on "primitive reflexes" such as the (a)symmetric tonic neck reactions and the tonic labyrinthine reactions.[4,11] These reactions coincide with the inertia patterns and can block unwanted rotation, especially around the midline, to stabilize posture. McMillan allowed these reactions, to some extent, to create midline symmetry as a starting point for coordinated rotational control.

McMillan also considered the commonly held views on buoyancy. Of specific interest to him, however, was the efficacy of weightlessness. He believed that postural "...tone is influenced by proprioceptive input stimulated by gravitational forces. In other words, tone is a function of weight" [4,11] which has been confirmed by others.[1,3,6,12,15] When a person is immersed in the water, proprio- ceptive input is compromised and postural tone is reduced. Tactile information is enhanced and "the system" may rely on primitive reflexes or less coordinated motor behavior to monitor and control movement and posture in an environment with altered sources of feedback. McMillan also noted that the effect of weightlessness on tone reduction was present regardless of water temperature. He was often heard saying "there is no such thing as cold water."[7]

HALLIWICK: THE TEN-POINT PROGRAM

The Ten-Point Program is a motor learning sequence that focuses on postural control to teach swimming. Ten successive steps lead students to experience water: buoyancy, flow, and waves, as well as the gradual decrease of support by the instructor during activities in upright positions. An important part of mental adjustment is breath control. Breath control focuses on expiration in order to prevent inhaling or swallowing water. Breath control also facilitates forward movement of the head which is essential for balancing activities in water. Early in mental adaptation, support is given starting at the shoulder girdle and (depending on student needs and abilities) changing to either the hands or the pelvic girdle. Support is never provided at the head since it is most critical to balancing. Gradually, support is withdrawn. This withdrawal is called disengagement.

Disengagement is the most important job of the instructor. When given too much support, the student will not be challenged to balance. When there is too little support, stress reactions may occur that interfere with the desired outcome variables (Figure 3). The desired outcomes result from feedback that the student receives about improvements. This feedback can come only from properly supported experiences that enable the student to practice and master the skills.

Disengagement is a continuous process of changing supports and using hydrodynamic elements to increase difficulty and challenge stability (Figure 4).

Each activity or skill introduced will require a different amount of disengagement. The purpose is to teach the student to balance in as open a kinetic chain as possible. Finally, while disengagement is especially addressed in the first phase of the Ten-Point Program, it is utilized in all steps when new skills are introduced.

and master (control) in a variety of movement patterns, with the outcome being a functional swimming stroke. The three phases (originally four) of the Ten-Point Program (Figure 2) represent an effective method for teaching swimming to both individuals who are able-bodied and those with a disability.

The three phases include mental adaptation, balance control and movement. The purpose, goals, strategy and therapeutic outcome for each of these phases will be described.

Mental Adaptation

Mental adaptation includes mental adjustment and disengagement. It encompasses adjustment to the properties of

Ten Points	Phases
1. Mental Adjustment and Disengagement	Mental Adaptation (Adjustment)
2. Sagittal Rotation (Control) 3. Vertical Rotation (Control) 4. Lateral Rotation (Control) 5. Combined Rotation (Control) 6. Upthrust / Mental Inversion 7. Balance in Stillness 8. Turbulent Gliding	Balance Control
9. Simple progression 10. Basic Halliwick Movement	Movement

Figure 2: The Ten-Point-Program and the three phases of the Halliwick Concept.

Novel Skill	Controlled Skill
Variable execution	Consistent execution
Inaccurate; clumsy	Precise
Slow	Fast
Much co-contraction	Smooth
Visual control needed	No visual control necessary
Visible postural adaptations	Invisible postural adaptations
Stiff in performance	Flexible in performance

Figure 3: Effect of feedback and experience on changes in motor behavior (Smits-Engelsman, 1999).

Simple Equilibrium	Methods to Challenge Balance
Support at the shoulder girdle	Shift support caudally
Support at hands	Shift support centrally
Many points of support	Less/no points of support
Water depth around Th11	Water depth above Th11
Large radius	Reduction of radius
Wide base	Small base
Compensating hand movements (e.g. sculling)	No hand movements
No (turbulent) flow around the body	Flow around the body
No waves	Waves
No metacentric effects	Metacentric effects

Figure 4: Methods to increase difficulty during disengagement

Therapeutic outcomes during phase one, mental adaptation, are first evident with the mouth-breath control activities. Specifically, mental (water) adjustment aids lip closure, vocalization and diaphragm activities. Addressing head-trunk control results in reduction of hypertonicity, disassociation, facilitation of righting reactions and symmetry. Finally, water adjustment activities include games that enable practice and training of functional behaviors such as walking, jumping and turning.[8, 14]

Balance Control

Phase two, balance control, includes balance restoration on a variety of axes, mental inversion (upthrust), "balance in stillness" and turbulent gliding. Balance control is the ability to independently maintain or to change a position in the water. Initially, control will be inefficient, with large (unnecessary) peripheral movements. The client must learn a fine degree of automatic and centralized balance control to prevent unwanted movements and to achieve efficient postural control. In the first step in this phase, the student learns to control (restore) sagittal, vertical, lateral and combined rotation to establish postural control. Sagittal rotation is done in an upright position and is a bending from left to right or transferring weight. Vertical rotation is around the transverse axis with the clients moving from standing to supine to standing position. Lateral rotation is around the spine producing a 360 degree roll. Combined rotation, which is a combination of the vertical and lateral rotations or the sagittal and lateral rotations, is used to teach the concept of "roll out of trouble." It is an over-rotated, forward vertical, or sideways sagittal rotation with the client being taught to roll to a face-up position (lateral rotation).

When the client has mastered rotation, upthrust, or mental inversion, is introduced. It is simply the concept that buoyancy will bring objects and people to the surface. The student learns to submerge, and, upon surfacing, uses one of the rotation patterns to achieve a comfortable breathing position.

The first five steps of balance control require a maximum amount of movement. Gradually, as the student learns to master the rotational patterns, they are introduced to static aspects of the program that will require a fine degree of centralized postural control. In "balance in stillness," clients assume a variety of positions, from standing to floating. The instructor uses a variety of variables such as turbulence or tactile stimulation (see Figure 4) to compromise the clients' balance or stability. Mastery is when the client can achieve stillness.

When "stillness" has been mastered and the student can maintain body position, the instructor introduces movement in the water with turbulent gliding. The student, in a supine position, is passively moved through the

Photo 1: Sagittal Rotation Control: working on righting reactions and lengthening of the trunk.

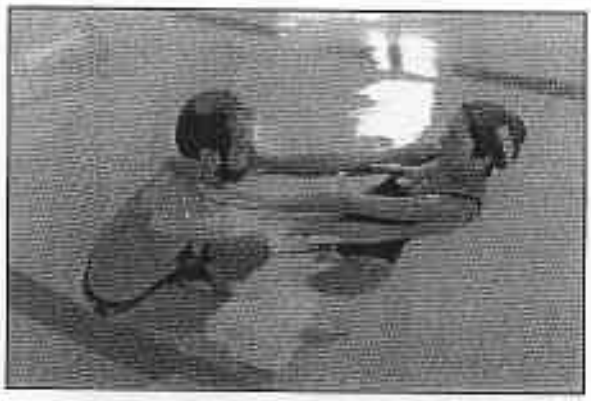

Photo 2: Vertical Rotation Control: exercising symmetry and selectivity during graded extension.

Photo 3: Lateral Rotation Control: the very important breath control in a proper alignment.

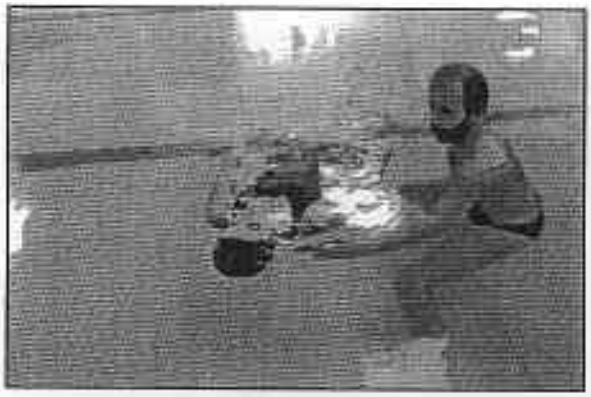

Photo 4: Balance in Stillness: turbulence creates rotation and the swimmer has to stabilize hips and spine.

water by the instructor who walks backward, dragging the client in the wake produced. The instructor may also produce manual turbulence under the client's shoulders. The client must maintain a still and balanced body position without increase of radius, sculling or increase in tone. This step allows the client to experience a centralized postural control while being dragged through the water.

There are many therapeutic benefits in phase two of the Ten-Point Program. Sagittal rotation increases spinal range of motion or spinal stabilization. It also aids in reaching and balancing sideways. Sagittal rotation also facilitates righting and supporting reactions.

Vertical rotation is a kind of disassociated or selective extension. All components of this chain can be exercised including positioning of the head on the trunk, working on scapular depression, extension of the dorsal spine, positioning of pelvic tilt, eccentric activity of the abdominals and dynamic stability of the knee joints.

Lateral rotation facilitates righting reactions between head, shoulder girdle and pelvic girdle. Obliques are very active in stabilizing the components relative to one another. Control over lateral rotation is of utmost importance during swimming, walking and many other functional activities.

Combined rotation has the same benefits as mentioned above and is more functional working in three-dimensional patterns.

"Balance in stillness" (and to some extent, turbulent gliding) is being used in all cases where stabilization of trunk, pelvic area and lower extremities have to be addressed. This point forms a bridge to the Water Specific Therapy and will be more fully described later.

Movement

Movement, which includes simple progression and a basic swimming movement, is the final phase of the Ten-Point Program. At this point, the student is able to create effective, efficient and skilled movement in the water. Once turbulent gliding is mastered, clients are taught a simple progression that enables independent movement through the water. While progressions may need to be customized for each client (based on functional abilities, body composition and symmetry), self-propelling movements are usually some form of sculling. The sculling activity is gradually advanced to the Halliwick swimming movement, which is a double-sided rowing activity with both arms symmetrically in the supine

position.

The most dramatic therapeutic outcome from the movement phase is dynamically trained trunk stability. During swimming the student has to propel effectively, which requires proper central coordination and synchronization. Swimming can also be regarded as a double task with automatic components of postural control.

SUMMARY

The Halliwick concept began as a method for teaching swimming to children with physical disabilities. Fifty years of development and implementation have enabled swimming instructors to identify therapeutic outcomes resulting from use of Halliwick Concepts. Recognizing the efficacy of the Halliwick Concept as a therapeutic intervention, McMillan and others sought to apply the mechanical effects of water on the body to aquatic therapy. The resulting strategy is known as Water Specific Therapy (also called the Logic Approach to Therapy in Water). The elements of Water Specific Therapy as well as treatment examples (case studies) will be presented in The Halliwick Concept - Part 2.

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CLINICAL REPORT

The Halliwick Concept, Part II

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ABSTRACT:
James McMillan developed the Halliwick Concept over 50 years ago. In Part I (Volume 8, Number 2), the basic Ten-Point program was presented. In Part II, expanded operational definitions and the application of Water Specific Therapy is examined.

Key Words:
Halliwick Concept, Water Specific Therapy, Aquatic Rehabilitation

Editors Note:
The reader is reminded that several of the concepts and definitions used in this article are outlined and described in The Halliwick Concept – Part I. A review of Part I is strongly recommended.

Also, this presentation is an accurate interpretation of James McMillan's Halliwick Ten-Point Program as a school of thought; and, therefore may not necessarily reflect certain viewpoints held by aquatic therapists practicing in the United States.

INTRODUCTION

Water Specific Therapy (WST) was founded on the mechanical effects of water on the body, just as the Ten Point Program (see Halliwick Concept Part I),[1] but applied for purposes of aquatic therapy.[2-6] This approach is most suitable for adults with neurologic, orthopedic or rheumatologic disorders. WST is not a group of exercises such as the Bad Ragaz Ring Method. Rather, it is a clinical decision making system that contains elements to plan, execute and assess aquatic therapy applications.

A therapist can choose an infinite number of options to produce the desired outcome. The elements of WST include:

- the treatment objectives
- the rotational plane
- the starting positions
- the exercise patterns
- the treatment techniques
- the modes of treatment.

Each element of the WST will be explained with several cases given.

TREATMENT OBJECTIVES (TO)

The purpose of the WST is to enable a patient to improve functional abilities on land. McMillan was quick to point out that "…if you can do it on land, don't do it in water". (2) However, if aquatic therapy can enhance an individual's functional abilities, then treatment in the water should be used as an extension or compliment to land therapy. McMillan identified seven objectives that he believed could be enhanced with the WST. The objectives are to: (1) strengthen weak muscle groups (+WMG), (2) increase range of motion / stretching (+RM), (3) facilitate posture and balance reactions (FPBR), (4) increase general physical condition (+GPC), (5) reduce pain (-P), (6) reduce spasticity (-Sp) and (7) increase mental adaptability (+IMA). The abbreviations were used to develop short, succinct treatment plans and will be demonstrated later.

Physiological rules on muscle strengthening, cardiovascular training and stretching of connective tissue should be considered in relation to these objectives. Once an assessment has been completed and treatment objectives identified, the therapist selects the appropriate rotational plane, starting position, exercise patterns, treatment techniques and mode of treatment. [NOTE: Facilitation of posture and balance reactions is a very broad objective and applicable to most individuals with neurological impairments. Currently, therapists using the WST have narrowed the FPBR objective to include such intents as symmetry, disassociation, centralization, reciprocal motion, etcetera.[5]

ROTATIONAL PATTERNS (RP)

Selection of the best rotational plane is based on the effect of impairment on the patients' body shape and density. For example, a patient who is hemiplegic may be taught side-flexing activities produced with sagittal rotation (SR) to assist with learning posture-righting reactions when in the vertical position.

The same patient might begin work in lateral rotation (LR) along the longitudinal axis to facilitate posture and balance reactions when in supine. An individual with an endoprosthesis hip with muscular instability in the

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frontal plane might work in vertical rotation (VR) along the transverse axis to strengthen weak muscle groups or facilitate posture and balance reactions, see the third case history. A person with severe spastic quadriplegia might work in combined rotation (CR) along the combined axis to reduce spasticity, increase range of motion and enhance symmetry and extension.[1]

STARTING POSITIONS (SP)

Starting positions are designed to cause predetermined biomechanical and hydrodynamic effects. The water depth (WD) affects standing positions in which the patient is standing. Generally, patients standing in water at T11 are neutral (N±). Patients in water above T11 (N+) experience increased effects of buoyancy, are relatively non-weight bearing, and have reduced proprioceptive input. Balance is maintained mainly with the head. As the water level drops below T11 (N-), the patient experiences reduced effects of buoyancy, increased weight-bearing, and more proprioceptive input. The lower extremities have an important role in weight bearing. (See also the section on treatment techniques.)

A classic starting position in the Halliwick Concept is the "cube" or sitting position at N+. In Figure 1 the cube is adapted to enhance head activity.

The patient basically appears as if they are sitting at a table with arms stretched in front on the table. Hips and knees are in 90° of flexion, back is straight, feet flat on the bottom with feet and knees slightly apart and arms stretched out in front the entire length.

A variation is shown in Figure 2: the bicycle position. This position can be used to facilitate head control, giving a closed chain through the shoulder girdle. The fixed points in the "cube" position are between feet and floor and offer less help than the bicycle when working on head balance.

Figure 1 Cube Position

The kneeling position is the same as the "cube" except the patient is resting on the knees. In the supine or back-lying position, at N+, the lumbar spine is in neutral alignment, hands at the side or apart (depending on the amount of trunk stability), head neutral or slightly flexed, hips in neutral flexion with legs together and feet in dorsiflexion. The prone position or front-lying position, at N+, places the lumbar and cervical spine in an extended position and is seldom used. In the oblique position, at N+, the body is in neutral extension, angling diagonally in the water with the feet on the bottom and with the face floating above the surface of the water.

Figure 2 Bicycle Position

TREATMENT TECHNIQUES (TT)

WST uses seven treatment techniques to disrupt the metacentric balance. The disruption might force an individual to use inertia patterns to develop postural control, balance and movement. While each of these techniques will be discussed individually, one should understand that each technique could produce multiple results. For example, when a patient is challenged to regain posture and balance, that individual will perform isometric and dynamic activity with variable resistance that will aid in the strengthening of weak muscle groups. McMillan believed that buoyancy, and the concomitant weightlessness, could lead to a reduction in certain types of spasticity or hypertonicity. The reduction of hypertonicity coupled with increased movement and strength of weak antagonists will enable the patient to experience greater active range of motion. All of the activities and hydrodynamic forces will create a favorable environment for a reduction in pain. While the general purpose of each treatment technique will be described, one should consider the broader impact on the patient.

The first two treatment techniques are gravity dominant and upthrust dominant activities, which involve using gravity or buoyancy to alter or aid patients' postural control, balance, and movement.Upthrust dominant activities (N+) will focus on head control and open chain work, while gravity dominant activities (N-) involve more weight bearing and lower extremity work.

When entering a pool, buoyancy is the most challenging property of water to be met. Buoyancy becomes most influential when the lungs become immersed, at the level of T11 or the xyphoid. When walking from the shallow part to the deep end of the pool, weight bearing is lost quickly at T11.[1] At this time, posture and movement must adapt quickly as well and control with the head and upper extremities overrides control of the lower extremities because contact between feet and ground diminishes as described by Becker and Harrison.[7,8]

The third and fourth treatment techniques are turbulence assisted and

turbulence resisted. In the assisted technique, the therapist manually produces turbulence to assist the patient to maintain postural control and balance as well as to achieve movement. The turbulence resisted techniques are designed to challenge a patients' ability to maintain postural control, balance and/or movement. By producing turbulence, the therapist can work without touching the patient in order to avoid compensatory activity.

McMillan's explanation for the fifth treatment technique, the metacentric effect, was that "...when a body part is lifted out of the water, the body rotates to try to get that part of the body back under the water."[1] He referred to the force-couple gravity and buoyancy by stating that any change in the force-couple produces a torque and a rotation of the body. The therapeutic impact is that the patient must resist the rotation to maintain balance. (See Figure 3.) Maintaining balance requires the patients to work in a rhythmic fashion, while performing stabilizing isometric activity of the muscles controlling the joints of the spine and lower extremities.

The wave of transmission is a technique used for improving postural stability. The patient walks through the water one step forward and stops. The incoming wave will push the patient from behind. The challenge is for the patient to hold a balanced position until the wave has passed.

Two facilitation techniques are also used in the WST. The first is specific stimulation of the skin and connective tissue underneath. This can produce various postures, balance and movements, depending on the amount of stability being given. When the patient is supported at the center of balance, light strokes or tapping is all that is needed. With peripheral - firm - supports, patients may use the leverage to work in closed chains to stabilize posture. Supports at the center of balance and stimulation will

Figure 3 Resisting rotation to maintain balance

produce balance reactions in open chains.

The second facilitation treatment technique is transference. It is engaging the patient in movement first on the unaffected side of the body with an attempt to perform the same movement on the affected side. The notion is that the patient will be able to transfer learning to the affected side since only small contractions (changes in body shape) are needed to facilitate movement and feedback of these movements. This movement has effect on a spinal level, following the principles of overflow of excitation, as in PNF. Moreover, the patient is asked to feel the movement and to reproduce that feeling on the affected side/area. This would be a kind of visualization technique to facilitate a correct motor pattern.

EXERCISE PATTERNS (XP)

Treatment techniques are applied in certain exercise patterns. The exercise patterns used in the WST can be described as symmetrical, asymmetrical, cross lateral or bilateral. In symmetrical patterns, both sides of the body are performing at the same time. When only one side of the body is performing it is asymmetrical. Cross-lateral patterns involve the upper extremity on one side and the lower extremity on the opposite side performing an activity. Finally, bilateral patterns are either upper or lower extremities performing in unison.

MODE OF TREATMENT (MT)

The final aspect of WST as an aquatic therapy technique is the Mode of Treatment that considers the phase and elements of treatment delivery. The phases in the WST (pre-training, inhibition, facilitation, dynamic) are similar but not identical to the phases (mental adaptation, balance control, movement) of the Ten Point Program. As can be seen in Figure 4, the points are organized in a slightly different manner. The goals of each phase are also different in that the goals of the WST are directed toward therapy outcomes as opposed to swimming abilities.

The elements of treatment delivery include the selection of appropriate interventions from the first five aspects (treatment objective, rotational patterns, starting positions, exercise patterns and treatment techniques) of the WST as well as the intensity of the activities chosen. Intensity can include many factors such as (but not limited to) amount of

The Four Phases of the WST to Exercise in Water	The Three Phases and Ten-Points of the Halliwick Program
1. Pre-training	1. Mental adaptation
• Mental adjustment & disengagement	• Mental adjustment
• Sagittal rotation control	• Disengagement
• Vertical rotation control	2. Balance Control
• Lateral rotation control	• Sagittal rotation control
• Combined rotation control	• Vertical rotation control
• Upthrust & mental inversion	• Lateral rotation control
2. Inhibition – Posture control	• Combined rotation control
• Balance is Stillness	• Upthrust (mental inversion)
3. Facilitation - Change of posture or shape or change of base	• Balance is stillness
• Controlled movement	• Turbulent Gliding
4. Dynamic – Change of posture, shape and base	3. Movement
• Challenging controlled movement	• Simple progression
	• Basic swimming movement

Figure 4 Comparison of the Ten-Point Program and WST

weight-bearing, velocity, change of radius and levers, length of time, visual control and position during movement. (See Figure 5.) The decisions regarding which aspects and intensities to employ are based on the phase of the program in which the patient is participating. Each phase, point and element of the WST will be explained.

Pre-training In order for the WST to be effective, a patient must have achieved the first six steps of the Ten-Point-Program (see Figure 4). A prerequisite for aquatic therapy is that the patient experiences comfort (mental adjustment) and independence (disengagement) in the water. Therapists must assure that patients can tolerate the physiological response to immersion and hydrodynamic factors, exhibit comfort with water on the face and in the ears and demonstrate breath control. Once a patient has achieved mental adjustment and disengagement, the therapist assists the patient to master sagittal, vertical, lateral and combined rotation. The patient moves to one of the WST phases (inhibition, facilitation, dynamic) when they are respectively able to submerge, rise to the surface and use a rotational pattern to achieve a comfortable breathing position.

Inhibition Inhibition is static posture control. Throughout the course of the intervention, the patients' posture, position, shape and base remain the same. The posture may be sitting ("cube" position), kneeling, standing, supine or oblique. The base is the bottom or side of the pool or support from the therapist. Postural control is challenged with the use of buoyancy only (gravity and upthrust dominate, N+, N-, N±). Activities in the inhibition phase can also be used for the reduction of pain or spasticity.

Facilitation Facilitation is dynamic posture control with changes occurring in the patients' position, posture and/or shape or with changes in the base. Examples of changing posture may be sitting to standing, supine to oblique. Examples of changing the base are walking (step/stop) and bicycling. (See Figure 2.) The base may be the bottom or side of the pool or support from the therapist. Postural control is challenged with metacentric effects or turbulence assisted/resisted activities with waves of transmission.

Simple Activity	Factors to increase intensity
Vertical position	Horizontal position
Visual control	No visual control
Many points of support	Less/no points of support
Water depth around Th11	Water depth above or below Th11
Large radius	Reduction of radius
Wide base	Small base
Short lever	Long lever
No (turbulent) flow around the body	Flow around the body
No waves	Waves
No metacentric effects	Metacentric effects
Short duration	Long duration

Figure 5 Factors to increase intensity of activities

Dynamic The dynamic phase is postural control with changes occurring both in the patients' position, posture and/or shape and the base. An example of changing posture is jumping. Postural control is challenged with metacentric effects and turbulence assisted/resisted with waves of transmission. Figure 6 shows how modes of treatment can be developed with respect to the treatment objectives.

TREATMENT EXAMPLES USI THE WST

The treatment examples will use the succinct format devised by McMillan. A narrative explanation describing all aspects of treatment intervention will be presented in th cases. (See Figure 7.)

Case 1 The patient is supported manually in a supine position, which is upthrust domina and therefore N+. The patient is as to correct pelvic position and find pain free position of the spine; this a symmetric activity in vertical rotation. The posture doesn't chang and thus this is referred to as inhibition.

Case 2 The patient must control posture in all directions (i.e combined rotation), at the same tim

+WMG: Strengthen weak muscle groups		Facilitation	Dynamic
+ROM: Increase range of motion		Facilitation	Dynamic
FPBR: Facilitate posture and balance reactions	Inhibition	Facilitation	Dynamic
+GPC: Increase general physical condition		Facilitation	Dynamic
-P: Reduce pain	Inhibition	Facilitation	
-Sp: Reduce spasticity	Inhibition	Facilitation	Dynamic
+IMA: Increase mental adaptability	Inhibition	Facilitation	Dynamic

Figure 6 Development of the mode of treatment with respect to the treatment objectives

	1. Aspecific low back pain, increasing with spinal extension	2. Athetosis: the body shows continuous movements	3. Endoprosthesis hip: loss of strength in the frontal plane
TO	-P	FPBR	+WMG
RP	Vertical rotation	Combined rotation	Vertical rotation
SP	Supine	Cube (open saddle)	Stand (and walk)
WD	N+	N+	N-
XP	Symmetrical	Asymmetrical	Asymmetrical
TT	Upthrust dominant	Metacentric, stimulation	Waves, turbulence
MT	Inhibition	Facilitation	Dynamic

Figure 7 Three examples showing WST Elements

in order to get symmetry. This asymmetric activity can best be done in an "open saddle position", using the impedance effects of water to dampen movements. Proper use of keypoints (a stimulation technique) and small changes of postures (metacentric effects) facilitate posture and balance reactions.

Case 3 The case of the patient with an endoprosthesis of a hip will be extended, since most patients do have more than one treatment objective. The patient not only suffers from a gluteal muscular instability in the frontal plane, but also has a limited extension of that hip joint and he is afraid to bear weight again because of a history of pain. Three examples, combining the elements of WST in one session will be given in Figure 8.

The patient has received a hip implant as a result of degenerative joint disease. The treatment objectives are to increase range of motion, to enhance the mental ability to bear weight and to strengthen weak muscle groups.

The starting position is supine lying, using buoyancy to increase ROM, followed by standing with the water depth around T11 (relatively non-weight-bearing with reduced proprioceptive input) to feel that weight bearing is possible. As the patient progresses, they will walk in a water depth below T11 (more weight-bearing, closed chain activity and proprioceptive input).

The passive pattern is symmetric (buoyancy works on both hips) and the active exercise patterns will be asymmetric because they focus on an asymmetric problem.

Treatment techniques are the use of upthrust to gravity dominance, metacentric effects, wave of transmission and turbulence resisted. The way these techniques are used is indicated with the mode of treatment. In this case the patient begins with inhibition and moves via facilitation to the dynamic phase. In the facilitation phase, the patient will maintain body position while changing the base. The patient will walk continuously, at a constant depth at N+. As more weight bearing can be tolerated, the patient will walk continuously at N-. The patient will not walk from N+ to N- but stay at a consistent depth. Walking in this manner will utilize not just buoyancy and gravity in the manner described earlier but turbulence in the form of drag as well. As the patient gains more strength and improves balance reactions, the patient will walk in a step/stop sequence to produce a wave of transmission challenging the patient to maintain balance. This activity will also be performed at water depths from N to N-. In the dynamic phase, the patient will change both position/posture and base. In this case the patient would start in the standing position and move from a jump/stop producing a wave of transmission.

SUMMARY

Working with physical therapists in Europe, McMillan elaborated on the principles of the Halliwick Method to describe a specific aquatic therapy technique: WST. This approach to aquatic therapy utilizes hydrodynamic forces, the metacentric effect, moments of inertia and primitive reflexes to enable patients to improve functioning on a variety of levels.

The Ten-Point-Program and the WST were originally used with individuals with neurological disorders. Today, they have applications for patients with many disabilities, particularly in neurology, orthopedics, pediatrics, geriatrics and behavioral health. In addition, the Halliwick Method has been used with

	Endoprosthesis hip: limited extension of the hip, being afraid to bear weight, reduced strength in the major glutei		
TO	+ ROM	+ IMA	+ WMG
RP	Vertical Rotation	Sagittal Rotation	Vertical Rotation
SP	Oblique supine	Stand	Stand and walk
WD	N+	N±	N-
XP	Symmetrical	Asymmetrical	Asymmetrical
TT	Upthrust dominant	Metacentric	Waves, turbulence
MT	Inhibition	Facilitation	Dynamic

Figure 8 WST Development in one session

other aquatic therapy techniques (the Bad Ragaz Ring Method and Watsu©)) to provide comprehensive treatment programs in the water.

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